Virginia Shellfish Aquaculture Situation and Outlook Report: Results of the 2016 Virginia Shellfish Aquaculture Crop Reporting Survey

Karen Hudson
Virginia Institute of Marine Science

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Executive Summary

The hatchery-based shellfish aquaculture industry in Virginia continues to grow adding significant value to the Commonwealth’s seafood marketplace. Today, watermen harvest both hard clams and oysters from the Commonwealth’s public resources, albeit at rates diminished from historic levels. At the same time, Virginia’s watermen-farmers, utilizing production from a land-based hatchery, are providing additional quantities of quality shellfish to consumers.

This survey, in its 11th year, is intended to continue annual assessments with which to gauge growth and inputs in Virginia’s hatchery-based shellfish aquaculture industry. This report is based upon an industry survey completed during the first quarter of 2017.

While these trends are widely acknowledged, until this annual survey was initiated in 2006 there had been no consistent reporting of production and economic trends in Virginia’s shellfish aquaculture industry. Periodic assessments are necessary to inform growers and related interests about the actual status and trends in the industry.

Highlights:

• 2017 farm gate value for Virginia shellfish aquaculture was $56.6 million
  $38.1 million Hard Clams
  $18.5 million Oysters

• Prices and markets remain strong for Virginia shellfish products
• Virginia is 1st in the U.S. for hard clam production
• Virginia is 1st on the East Coast of the U.S. for Eastern oyster production
• Virginia shellfish aquaculture directly employs hundreds of Virginians
• Clams are the biggest contributor to Virginia’s shellfish aquaculture economic value
• Oysters are the most rapidly developing sector of Virginia’s shellfish aquaculture
• The majority of Virginia’s shellfish production comes from a system of vertically integrated private hatcheries which are located on both the eastern and western shores
Methodology

A mail and Internet-based survey was developed to collect information from Virginia clam and oyster growers known to be active in the industry\(^1\). Each year, the survey instrument is evaluated and revised based upon field testing (Appendices 1 & 2). Sixty-three complete, useable surveys were returned via the Internet, mail, or fax, including responses from 15 clam growers, 58 intensive oyster growers, 7 extensive growers, 6 shellfish hatcheries, and 10 growers who cultured both molluscs. It is believed that the survey is representative of overall trends in 2016 and based on the majority of active commercial growers. For confidentiality reasons, the information collected is aggregated, and the total represents both the eastern and western shores of Virginia.

Summary of Findings

Shellfish Hatcheries\(^2\)

The vast majority of Virginia’s production comes from a vertically integrated system with eight commercial shellfish hatcheries, of various scales, producing clam seed, oyster seed, and oyster eyed larvae either planted by the hatchery owners themselves in their aquaculture operations, or sold to other Virginia growers (Figure 1). The hatcheries are widely distributed throughout coastal Virginia, located on western and eastern shores, both bayside and seaside. Oyster production occurs on both shores; however clam production occurs exclusively on the eastern shore due to the higher salinity requirement for this shellfish species.

Water quality remains a critical area for shellfish hatcheries. Water quality issues of unknown origin were reported by oyster hatcheries in 2009 and 2011 and show a clear impact on production as seen in Figures 1 and 5. Research is ongoing to understand the water quality parameters that negatively impact consistent production, with the goal of providing management tools for hatcheries to mitigate the issues.

Virginia Oyster (*Crassostrea virginica*) Aquaculture

Historically the most common oyster “culture” technique in Virginia was the transplanting of wild harvested seed to leased growing grounds. Prior to the onslaught of diseases, the grower paid little attention to the grounds between the time seed was planted and the time mature oysters were harvested, some 2 or 3 years later. This culture is still practiced today; however, the results here do not include information on such oyster planting. The results in this report reflect the use of aquaculture practices adopted as a result of increased oyster disease and predation which utilize only hatchery produced seed and larvae.

There are two methods of hatchery-based oyster aquaculture production in Virginia: intensive culture (off bottom) and extensive culture (on bottom, or spat-on-shell). Both typically use genetically improved stocks and triploid, or “spawnless” oysters. Industry reports that the sterile triploid seed is more viable from a commercial standpoint, as the oysters grow faster and do not diminish in quality with seasonal spawning. Triploid eyed larvae and seed continue to be the source of the overwhelming major-

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\(^1\) Virginia Marine Resources Commission’s Licensed Aquaculture Product Owners List.

\(^2\) The expansion of oyster hatchery infrastructure in 2009 prompted the addition of hatchery-specific survey questions in 2010. Hatchery questions were then relocated to a standalone survey sent directly to the shellfish hatcheries beginning in 2011 (Appendix 2).

Virginia Shellfish Aquaculture Situation and Outlook Report
ity of the oyster sales reported by hatcheries at 87% and 94%, respectively.

**Intensive Culture (cultchless method using single seed)**

Intensive culture uses cultchless, or single seed. This seed needs to be containerized for predator protection. Containerization varies but generally consists of oysters deployed in bags within cages that sit approximately 12 inches off the bottom. Intensive oyster culture requires more labor in gear and product maintenance and is generally considered more expensive. However, the end result is a single, more uniform product that has the ability to obtain a higher price in the boxed and half shell markets.

Figure 2 shows a reported 106.3 million single oysters planted in 2016 which is a 22% decrease from 2015. The outlook for 2017 suggests an 11% increase in oysters planted by Virginia growers, to 118 million single oysters planted.

**Oyster Sales and Prices**

Four of the 58 oyster survey responses indicated some sort of cooperative relationship to market, but most arrangements were similar to those with contractors - with no equity exchange, such as, providing seed\(^1\). The 2016 results indicated the total number of market oysters sold by Virginia growers, subtracting the reported sales from those indicating involvement with a cooperative, was 40.2 million (Figure 3). This was an increase of 13% from 2015 but 14% less than growers predicted from the previous survey. Survey respondents forecast a 21% increase for 2017 sales which, if reached, would translate to nearly 49 million market oysters sold. A marketing concern reported from many growers in 2016 was the heavy wild spat fall on the cultured product.

For the purposes of this report, oyster prices are not broken down as to market segment (i.e. primary wholesale, secondary wholesale, retail, etc.). Figure 4 shows an average price of $0.41 per oyster in 2016; no change from the previous year\(^4\). Trends in the percentage of single oysters sold into wholesale markets remain fairly consistent at greater than 90% for the last eight years. The percentage of single oysters sold out of state in 2016 was 59%. This export level has

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\(^1\) In 2013, the crop reporting survey was expanded to ask whether the grower has a “cooperative” agreement with a larger oyster producer who would likely report the sales numbers. This was due to reports of oyster cooperative arrangements and was an effort to reduce the potential for double counting oyster sales.

\(^4\) During 2016 the median price was $0.40 per market oyster, an increase of $0.02 from 2015. The weighted average price was $0.410 per market oyster in 2016, an increase of $0.01 from 2015.
ranged between 56 % and 86% for the last seven years.

Combining the overall sales of single, market oysters with the weighted average price of $0.42 per oyster, it is estimated that the total 2016 revenue for oyster aquaculturists (not including spat-on-shell production) was $16.5 million, a 14% increase from 2015.

### Extensive Culture - Spat-on-Shell

Extensive culture is also referred to as spat-on-shell. The primary advantage of spat-on-shell cultivation is that it requires less labor and fewer materials than single oyster cultivation, thereby making it a more economically feasible option for producing large quantities of oysters. Oyster eyed larvae is purchased from the hatchery and transported to the remote setting location. The eyed larvae are set in land-based tanks on bushels of clean oyster shells, referred to as cultch. The bushels of shell struck with larvae are planted directly on the bottom and harvested within two years. Because spat-on-shell cultivation produces oysters grown in clusters (similar to wild-caught oysters), the primary product is predominantly oysters for shucking rather than single oysters for half-shell consumption. For this reason, remote setting is not meant to take the place of single oyster culture, which produces consistent, high quality, half-shell oysters, but to complement it with a means of producing, on large scale, a local oyster for use by Virginia’s oyster processors.

The spat-on-shell process has been enhanced since its start in 2008. Improvements in the quality of eyed larvae coming out of the hatcheries and optimized remote setting methods have cut in half the number of eyed larvae required per bushel of shell. While large-scale spat-on-shell cultivation has been used in Virginia for the last several years, federal monies had subsidized a large portion of this development which impeded relevant forecasting. These subsidies are gone, allowing for inclusion of industry trends. In 2016, growers reported planting 49,100 bushels, a 6% increase from 2015. The industry forecast for 2017 is to increase by 10% to 54,000 bushels. The industry’s expansion depends on a consistent production of large quantities of eyed larvae, which can be problematic due to poor water quality.

### Spat-on-Shell Sales and Prices

In 2016, growers reported harvesting 42,620 bushels of spat-on-shell which was a 28% increase from 2015. Expectations for 2017 are an increase of 49% to 63,000 harvested bushels of spat-on-shell. The average price per bushel was $46 making the 2016 farm gate value for spat-on-shell nearly $2 million; a 28% increase from 2015.

### Oyster Hatchery Sales

Since 2008, the expansion of large-scale oyster spat-on-shell in Virginia has changed hatchery volume, as shown in Figure 5. Existing firms became active in purchasing not just cultchless oyster seed, but large quantities of oyster eyed larvae for spat-on-shell development. In 2016, hatcheries reported an increase from the prior year in sales of both the single seed and eyed larvae. A total of 264 million single seed were sold in 2016 along with 2.9 billion eyed larvae. These numbers represent a 22% and 12% increase from 2015 sales, respectively. The average price of eyed larvae has shown a continual increase over the past four years and in 2016, it increased 4%, to $326 per million.

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1 According to prior grower survey reports, the number of harvested bushels of spat-on-shell has continually increased from roughly 2,000 in 2009 to almost 13,000 in 2012 and over 38,000 bushels in 2014. These numbers include a mix of plantings funded by private investment and subsidized support.

6 Over the last four years, Virginia hatcheries have reported selling a percentage of their total seed and eyed larvae production out-of-state. These sales support development of oyster aquaculture in surrounding states with limited, or no private hatchery capability of their own.
**Employment**

Finally, as shown in Figure 6, employment associated with oyster aquaculture, which has remained varied over recent years, shows no change in the number of full time and a decrease in part time employment in 2016. The difficulty of estimating the time and labor associated with relatively small-scale aquaculture conducted in conjunction with other business lines makes estimates of oyster culture labor problematic at this point in industry development. In view of this fact, the trends in these employment figures should not be overly interpreted. There is consistent expectation that with successful development of both spat-on-shell and cultchless oyster aquaculture, additional employment will be required to meet the greatly expanded planting and production needs.

**Hard Clam (*Mercenaria mercenaria*) Aquaculture**

Clam aquaculture is a relatively mature aquaculture industry that has dominated over wild clam harvest in Virginia for more than a decade. Clams are not as low-salinity tolerant as oysters and thus the majority of clam production comes from the higher salinity areas on the eastern shore including both bayside and seaside. Clams burrow into the sediment which makes the production methods much different than oyster culture. There is one method used for clam aquaculture in Virginia in which beds are planted in plots and covered with mesh net for predator protection. Planting to harvest is a two year process; longer than in oyster aquaculture.

Based on previous economic assessments compiled by the authors, Virginia continues to lead the nation in the production of cultured hard clams. As depicted in Figure 7, clam growers reported a 10% decrease in seed plantings during 2016 to a total of 476 million clams. The industry outlook for 2017 predicts an increase of 10% to 523 million individual clams planted.

**Clam Sales and Prices**

The 2016 crop reporting survey reflects a 5% increase in the number of market clams sold over the previous year, to 195 million, as shown in Figure 8. Based on the overall sales and the weighted average price of $0.195 per market clam, it is estimated that total revenue for hard clam aquaculturists in 2016 was $38.1 million—an increase of 18% from the prior year.
Figure 9 displays the survey findings regarding relative prices received for market clams. The average price reported per market clam at the farm gate increased by 18% to $0.20 during 2016. Trends in the percentage of market clams sold into wholesale markets have remained in the range of 94% to 99% for the last eight years and were reported at 99% in 2016. During 2016, 93% of market clams were sold out of state. This export level has remained between 85% and 93% for the last five years.

Clam Hatcheries
Clam seed production and sales have remained stable for the last several years as well as the reported average price of clam seed. Industry sources indicate much of the hatchery capacity is dedicated to producing seed for the hatchery owner’s own planting. Essentially, all of the seed produced is planted in Virginia. This vertically integrated system with eventual sales to many out-of-state consumers adds important economic development to local coastal communities.

Employment
Figure 10 demonstrates a decrease in both full time and part time employment in 2016. However, as noted previously, the employment situation for all shellfish aquaculture is complicated by the diversity of the firms involved. The vast majority of the clam production is conducted by relatively large vertically integrated companies; these companies often contract with self-employed grower cooperatives, which, as with oysters, complicate the estimates of labor involved in this industry.

Given the ambiguity of reporting labor used for both oyster and clam culture noted above, it is useful as a benchmark to review the economic impact model developed for Virginia shellfish aquaculture for the 2012 growing year. The IMPLAN model used for that assessment estimates that just under one (0.9) full time equivalent (FTE) is needed to produce $100,000 of cultured shellfish output. Based upon this model, 509 FTEs would be needed to produce the 2016 estimated output of $56.6 million; an increase of 15% over the 2015 estimate of 435 FTEs. These figures do not represent the indirect and induced employment multipliers.
Appendix 1: Grower Survey

Virginia Shellfish Grower Situation & Outlook Survey 2017

Welcome

Thank you for taking a few minutes to complete the following commercial aquaculture survey. This survey is meant to capture trends in hatchery-based shellfish aquaculture activity on private ground. If you do not participate in hatchery-based culture, please disregard.

With your help, Virginia’s past annual surveys have shown how useful timely information is for the shellfish aquaculture industry. Such information is vital to understanding the importance of Virginia’s growing aquaculture business to the economy, and in turn the importance of clean water, reasonable land use and tax policies, access to financial capital and the like to shellfish growers.

All information provided will be held in the strictest of confidence and used only when combined with all of those providing information on their individual operations.

Not all questions may apply to your situation. Please answer all that do. The more accurate the information provided, the better the characterization of the Virginia aquaculture industry.

Please complete the survey by February 17, 2017.

If you have any questions or would like to discuss, please contact:

Karen Hudson
Aquaculture Specialist
Phone: 804-684-7742
Fax: 804-684-7161

You can also file online by accessing https://www.surveymonkey.com/r/growersurvey2017

If filing online, please note your answers can be saved if you exit the survey before completion. You can then return at a later time to finish the survey.
### Virginia Shellfish Grower Situation & Outlook Survey 2017

**Commercial Clam Aquaculture**

1. **Do you aquaculture clams? (If NO, skip to #9)**
   - Yes ○
   - No ○

2. **Do you have a clam hatchery?**
   - Yes ○
   - No ○

3. **Do you “re-sell” seed?**
   - Yes ○
   - No ○

   *Do you grow small seed to a larger size for resale to another grower(s)*

4. **Do you have a “cooperative” agreement with a larger clam producer who will likely be reporting these numbers?**
   - Yes ○
   - No ○

5. **Do you purchase hard clam crop insurance?**
   - Yes ○
   - No ○

6. **2016 Commercial Clam Aquaculture**

   a) **# Clams planted**

   b) **% Seed purchased**

   c) **Ave. price of seed purchased**

   d) **# Seed sold**
      i. **% seed sold out-of-state**

   e) **# Market (non-seed) sold**
      i. **% wholesale**
      ii. **% retail**
      iii. **% market clams sold out-of-state**

   f) **Ave. price per market clam**
      i. **Avg. price wholesale**
      ii. **Ave. price retail**

   g) **# Full-time help**

   h) **# Part-time help**
Virginia Shellfish Grower Situation & Outlook Survey 2017

Commercial Clam Aquaculture

7. **2017 ESTIMATED** Commercial Clam Aquaculture

   a) # Clams planted
   b) % Seed purchased
   c) Ave. price of seed purchased
   d) # Seed sold
      i. % seed sold out-of-state
   e) # Market (non-seed) sold
      i. % wholesale
      ii. % retail
      iii. % market clams sold out-of-state
   f) Ave. price per market clam
      i. Avg. price wholesale
      ii. Ave. price retail
   g) # Full-time help
   h) # Part-time help

8. Comments or Explanatory Notes on 2016 or 2017 Clam Aquaculture:
Virginia Shellfish Grower Situation & Outlook Survey 2017

Commercial Oyster Aquaculture

This section covers two methods of commercial oyster culture: spat-on-shell and single oysters. Each method has its own series of questions.

9. Do you aquaculture oysters?  
   Yes ☐  No ☐

10. Do you aquaculture spat-on-shell oysters?  
    Yes ☐  No ☐
    This includes setting, planting, and/or harvesting of spat-on-shell.  
    (If NO, skip to #14)

Note: Some of you may purchase eyed larvae for setting single seed. Do not include this activity in the spat-on-shell section. It can be included in the cultchless oyster section.
Virginia Shellfish Grower Situation & Outlook Survey 2017

Commercial Spat-on Shell Oyster Aquaculture

*Please report only oyster production which originated from an onshore hatchery. This does NOT include “natural strike” product moved to private ground. This does NOT include larvae purchased for setting single seed.

11. 2016 Commercial Spat-on-Shell Oyster Aquaculture
   a) # Eyed-larvae used
      i. % Diploid
      ii. % Triploid
   b) % Eyed-larvae purchased from out-of-state
   c) # Bushels spat-on-shell planted
   d) # Bushels “market-size” spat-on-shell harvested/sold
   e) Ave. price received per bushel of “market-size” spat-on-shell

12. 2017 ESTIMATED Commercial Spat-on-Shell Oyster Aquaculture
   a) # Eyed-larvae used
      i. % Diploid
      ii. % Triploid
   b) % Eyed-larvae purchased from out-of-state
   c) # Bushels spat-on-shell planted
   d) # Bushels “market-size” spat-on-shell harvested/sold
   e) Ave. price received per bushel of “market-size” spat-on-shell

13. Comments or Explanatory Notes on 2016 & 2017 Commercial Spat-on-Shell Oyster Aquaculture:
**Virginia Shellfish Grower Situation & Outlook Survey 2017**

**Commercial Oyster Aquaculture**

14. Do you aquaculture cultchless (single) oysters?  
*Yes ☐  No ☐ (If NO, skip to #20)*

15. Do you re-sell oyster seed?  
*Yes ☐  No ☐  Do you set larvae for single seed and/or grow small seed to a larger size for resale to another grower(s)*

16. Do you have a “cooperative” agreement with a larger producer who will likely report your numbers of planted and sold?  
(This does NOT include sales to a wholesaler)  
*Yes ☐  No ☐*

**Cultchless (single) Oyster Aquaculture**

*Please report only commercial oyster production which originated from an onshore hatchery.*

17. **2016 Commercial Single Oyster Aquaculture**

<table>
<thead>
<tr>
<th>a) # Oyster seed planted</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. % diploid</td>
</tr>
<tr>
<td>ii. % triploid</td>
</tr>
<tr>
<td>b) Avg. price of triploid seed purchased ($ per 1,000)</td>
</tr>
<tr>
<td>c) % Planted seed purchased from out-of-state</td>
</tr>
<tr>
<td>d) # Seed sold</td>
</tr>
<tr>
<td>i. % seed sold out-of-state</td>
</tr>
<tr>
<td>ii. Avg. price of seed sold ($ per 1,000)</td>
</tr>
<tr>
<td>e) # Market (non-seed) oysters sold</td>
</tr>
<tr>
<td>i. % wholesale</td>
</tr>
<tr>
<td>ii. % retail</td>
</tr>
<tr>
<td>iii. % market oysters sold out-of-state</td>
</tr>
<tr>
<td>f) Avg. price per market oyster ($ per piece)</td>
</tr>
<tr>
<td>i. Avg. price wholesale</td>
</tr>
<tr>
<td>ii. Avg. price retail</td>
</tr>
<tr>
<td>g) # Full-time help</td>
</tr>
<tr>
<td>h) # Part-time help</td>
</tr>
</tbody>
</table>
Virginia Shellfish Grower Situation & Outlook Survey 2017

Commercial Cultchless (single) Oyster Aquaculture

18. **2017 ESTIMATED** Commercial Single Oyster Aquaculture

a) # Oyster seed planted
   i. % diploid
   ii. % triploid

b) Avg. price of triploid seed purchased ($ per 1,000)

c) % Planted seed purchased from out-of-state

d) # Seed sold
   i. % seed sold out-of-state
   ii. Avg. price of seed sold ($ per 1,000)

e) # Market (non-seed) oysters sold
   i. % wholesale
   ii. % retail
   iii. % market oysters sold out-of-state

f) Avg. price per market oyster ($ per piece)
   i. Avg. price wholesale
   ii. Avg. price retail

g) # Full-time help

h) # Part-time help

19. Comments or Explanatory Notes on 2016 & 2017 Commercial Single Oyster Aquaculture:
20. Please provide any comments on the shellfish aquaculture industry situation.

21. Would you like to receive a copy of the overall report when completed?
   *If yes, please fill out the contact information below*
   
   Yes ☐  No ☐

22. Contact Information (Optional)
   *At a minimum please provide the zip code to inform where production is occurring*

   Name
   
   Company
   
   Address
   
   City, State, Zip
   
   Telephone
   
   Email

*Thank you for completing the Virginia Shellfish Grower Situation and Outlook Survey.*
Welcome

Thank you for taking a few minutes to complete the following commercial shellfish hatchery survey. With your help, Virginia’s past annual surveys have shown how useful timely information is for the shellfish aquaculture industry. Such information is vital to understanding the importance of Virginia’s growing aquaculture business to the economy, and in turn the importance of clean water, reasonable land use and tax policies, access to financial capital and the like to shellfish hatcheries and growers.

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Please complete the survey by February 17, 2017.

If you have any questions or would like to discuss, please contact me at:

Karen Hudson  
Aquaculture Specialist  
Phone: 804-684-7742  
Fax: 804-684-7161

You can also file online by accessing https://www.surveymonkey.com/r/hatchery2017
If filing online, please note your answers can be saved if you exit the survey before completion. You can then return at a later time to finish the survey.
# Shellfish Hatchery Production

## 1. 2016 Clam and Oyster Hatchery Production

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) # Clam seed produced</td>
<td></td>
</tr>
<tr>
<td>b) # Clam seed sold</td>
<td></td>
</tr>
<tr>
<td>i. % Clam seed sold out-of-state</td>
<td></td>
</tr>
<tr>
<td>c) # Oyster eyed larvae produced</td>
<td></td>
</tr>
<tr>
<td>d) # Oyster eyed larvae sold</td>
<td></td>
</tr>
<tr>
<td>i. % diploid</td>
<td></td>
</tr>
<tr>
<td>ii. % triploid</td>
<td></td>
</tr>
<tr>
<td>iii. % Oyster eyed larvae sold out-of-state</td>
<td></td>
</tr>
<tr>
<td>e) Ave price per million oyster eyed larvae sold</td>
<td></td>
</tr>
<tr>
<td>i. Ave. price diploid</td>
<td></td>
</tr>
<tr>
<td>ii. Ave. price triploid</td>
<td></td>
</tr>
<tr>
<td>f) # Single oyster seed produced</td>
<td></td>
</tr>
<tr>
<td>g) # Single oyster seed sold</td>
<td></td>
</tr>
<tr>
<td>i. % diploid</td>
<td></td>
</tr>
<tr>
<td>ii. % triploid</td>
<td></td>
</tr>
<tr>
<td>iii. % single seed sold out-of-state</td>
<td></td>
</tr>
<tr>
<td>h) # Full-time help</td>
<td></td>
</tr>
<tr>
<td>i) # Part-time help</td>
<td></td>
</tr>
</tbody>
</table>
Virginia Shellfish Hatchery Situation & Outlook Survey 2017

2. 2017 *ESTIMATED* Clam and Oyster Hatchery Production

Please indicate any changes in production, sales and employment expected for 2017. If no changes are expected, please write “same”.

3. Comments or Explanatory Notes on 2016 & 2017 Commercial Shellfish Hatchery:

4. Please provide any comments on the shellfish hatchery situation.

**Thank You**

5. Contact Information (Optional)

Name 
Address 
City, State, Zip 
Telephone 
Email 

*Thank you for completing the Virginia Shellfish Hatchery Situation and Outlook Survey.*
The complete report can be found online at www.vims.edu/map/aquaculture

VIMS Marine Resource Report No. 2017-7